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COWS LIKE COMFORT
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U.S. Department of Agriculture

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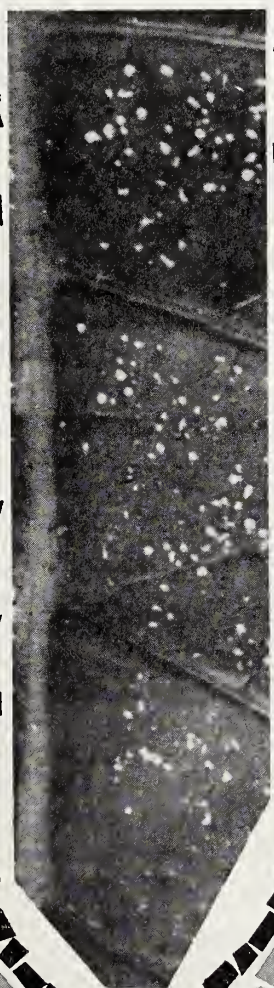

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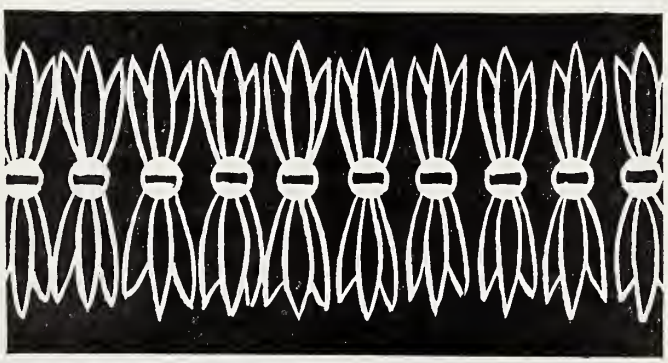

AGRICULTURAL
Research

Vol. 7—March 1959—No. 9

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Editor: J. F. Silbaugh. Managing Editor: J. R. Deatherage. Contributors to this issue: E. Evers, E. N. Cresci, M. S. Peter, C. E. Olsson, H. Hass, E. M. Devore, G. F. Snell.

Resource

In agricultural research, the most important resource is certainly the human one: competent scientists.

We're giving serious thought to increasing our basic research effort—in fact, to aiming all our research more directly toward finding basic answers to major questions. We must also give serious thought to training, recruiting, and holding scientists to do the kind of thinking this work requires.

The team approach is being used effectively in research, but that's no substitute for the best possible basic training of each team member. Study of the biological processes in agriculture has become more and more closely related to fundamental research in widely different fields—on enzymes, hormones, embryology, parasitology, and many other specialties. ARS Administrator B. T. Shaw recently emphasized the importance of strong undergraduate training in basic sciences. A solid background in these disciplines should improve the future work of those interested in research, and also improve our chances of recruiting better scientific talent.

To attract into research the kind of people we want, we might also do well to change some of our job terminology. Years ago, we asked for agronomists, horticulturists, or animal husbandmen, and we got people with the general training that those designations imply. Today we still tend to use the old names, but we're actually hiring geneticists, pathologists, biochemists, physicists, virologists, and so on. Dr. Shaw believes that many of today's high school and college students are more likely to be interested in agricultural research if we make it clear that we employ such specialists—that is, if we speak of our needs in the terms that students associate with science. We need to dispel the impression that agricultural research is somehow different from other science.

Once we've found an imaginative scientist, capable of self-directed work, how do we hold him? By maintaining the right environment for productive research. That means providing the help and facilities he needs, increased pay for personal growth, and—most important of all—an opportunity to work on something important without interference.

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MOVEMENT of NAA was traced by applying chemical tagged with radioactive carbon to one leaf of fruit-bearing spur. Autoradiograph (left) and photograph (right) show accumulation of NAA in the bud 5 days later.

Apples Every Year— through HORMONES

These chemicals encourage biennial-bearing apples to set even more fruit in the off year than usual methods of on-year thinning

■ EARLY THINNING OF THE CROP of biennial-bearing apple trees in their *on* year tends to cause more fruit set in the *off* year. Now USDA research shows that we can further increase off-year fruiting by using hormone-type sprays to do the thinning.

Naphthaleneacetic acid (NAA) and naphthylacetamide (NAAmide) are the two synthetic hormones that ARS horticulturists C. P. Harley, H. H. Moon, and L. O. Regeimbal have shown directly influence induction of blossom buds.

Removing part of the fruit crop either by hand or caustic sprays, if done early enough, breaks the biennial-bearing habit of apples. Amount of bloom in the off year is generally proportional to the degree and earliness of on-year fruit thinning. NAA sprays, however, seemed to encourage substantially more off-year blooming than could be expected from thinning. Studies at the Agricultural Research Center, Beltsville, Md., confirmed this additional effect of NAA on flower bud formation.

In one experiment, weak sprays of NAA were applied to York Imperial trees 4 weeks after full bloom. Little thinning effect was obtained. Concentrations used were 2, 5, and 10 parts per million of NAA plus 1 pint of Tween 20 in 100 gallons of water. Fruit set for the 3 treatments averaged 37.8 to 40.6 fruits per 100 blossom clusters. Untreated trees set an average 45.2 fruits per 100 blossom clusters. But in the succeeding off-crop year, 16.6 to 25.5 percent of the growing points of treated trees produced flower buds, compared with only 2.3 percent for unsprayed trees.

To pin down NAA's influence on bud initiation and eliminate thinning as a determining factor, tests were conducted on branches with reduced leaf systems. Earlier work had shown that defoliation to 2 or 3 leaves per bud during the off year greatly reduced the percentage of growing points initiating blossom buds for the heavy crop year.

In the off year, 2 branches each of 4 Golden Delicious trees were sprayed 21 days after full bloom with 10 p.p.m. of NAA plus 1 pint of Tween 20 in 100 gallons of water. Branches of 2 trees were defoliated to 2 large leaves per bud 8 days after spraying; branches of the other 2 trees were defoliated to 3 leaves per bud 9 days after spraying. Two branches on each tree were similarly defoliated but not sprayed.

On branches stripped to 2 leaves per bud and sprayed, 21.6 and 12.7 percent of the growing points flowered the next season, compared with 1.9 percent and 0 for unsprayed branches. Branches stripped to 3 leaves per bud flowered on 68.6 and 53.3 percent of the growing points when sprayed, 27.6 and 18.0 percent when unsprayed.

How NAA influences flower-bud formation is not known, but molecules tagged with radioactive carbon accumulated in relatively large amounts in the bud 5 days after spur leaves were treated. NAA's action in the meristem (growing point) may be to trigger the mechanism responsible for developing flower rather than vegetative buds.☆

BARGAINING COOPERATIVES PAY OFF

Experience of fruit and vegetable grower associations revealed by study of organization and operations

■ HIGHER PRICES to fruit and vegetable growers are only one of the advantages to be gained through bargaining cooperatives, USDA Farmer Cooperative Service research shows. More stable prices, improved sale conditions, better products, and more efficient marketing are some other returns that benefit growers, processors, and ultimately consumers.

Rapid growth of bargaining cooperatives, which negotiate price and other contract terms for grower members, led FCS to study the organization and operations of these groups. Their experiences, summarized in a recent report, may help others planning to organize similar groups.

Groups vary widely in size

The study revealed that the 15 fruit and 15 vegetable cooperatives now operating have a total membership of 15,000 growers. Individual associations range from under 100 members to over 5,000, and average about 1,100. Most groups deal in only one product. In 1956, the last year for which figures are available, associations negotiated sales totaling $61 million for their members.

Competitive position aided

Group action, the FCS found, helps growers maintain and improve their competitive position in a constantly changing market. As processors merge and expand activities, they become fewer, larger, and stronger. Grower associations can develop a comparable bargaining strength where they have sufficient tonnage signed up and adequate marketing information. Such cooperatives enable a fruit or vegetable grower to overcome the marketing disadvantage of a bulky perishable crop that can't be stored or shipped long distances.

Associations, moreover, aid growers by collecting economic and marketing information on which to base contract negotiations. From such information, growers become aware of market trends and demand for their crops—thus can adjust production to consumer requirements and produce the quality or grade most desired.

Processors also benefit. They are assured of a continuing supply of quality products when the supply of a fruit or vegetable is concentrated in an association. And field work and contract signup cost less.

Certain restrictions apply

Bargaining groups are similar to other cooperatives in their organizational setup and legal status. While bargaining associations can attain a strong position in the market, they do not have complete immunity from the restraints of the Sherman Anti-Trust Act or the prohibitions of the law administered by the Federal Trade Commission. Also, the price-making power of these associations is limited by competition from other regions and other food products.

Experience of the active associations indicates several points that groups planning to organize a bargaining cooperative should consider:

1. A group should first make sure that there is an economic need for a bargaining cooperative.

2. A group should sign up a sufficient proportion of commodity tonnage to be of concern to a processor.

3. Adequate marketing and economic information is necessary for realistic negotiation. There should be constant collection and analysis.

4. Efficient management is needed.

5. Good relations between members and management are based on a two-way flow of information.

6. Reasonable demands, cooperation with industry on joint problems, negotiations in good faith, and other actions based on an industry-wide approach, all contribute to the long-run success of a bargaining group. ☆

ROLLER GINNING'S STILL BEST FOR LONG FIBERS

Older gin is slower but saves in long run by yielding higher quality, more adaptable lint

■ CAN WE REDUCE PRODUCTION COSTS of our extra-long-staple Pima S–1 cotton by replacing roller ginning with cheaper and faster saw ginning?

No, say USDA researchers, at least not under present methods of roller and saw ginning. For processing this extra-long-staple cotton, the saw gin can't match the roller gin in the quality and adaptability of its product. (The older and slower roller gin pulls lint from the seed with a roller, a large stationary knife, and a moving knife; the saw gin removes the lint with a circular saw.)

Cotton men have long known that saw gins, as now operated, damage the long, fine fibers that go into high-quality cotton products, such as sewing threads and dress goods. But if we could find a practical way to saw-gin Pima S–1 cotton without damaging the fiber, the resulting lower-cost lint could better compete with imported extra-long-staple cottons—and even find new markets, especially where such cottons are not used now.

So an experiment was set up by the ARS Crops Research, Agricultural Engineering Research, and Southern Utilization Research and Development Divisions.

The tests showed that roller-ginned Pima S–1 cotton processed better and produced higher-quality and better-looking yarns and fabrics. There was less card waste in spinning, and spinning performance was better. So, despite the fact that roller ginning is slower and costlier, it's probably more economical in the long run.

This finding means that we can now devote our efforts to decreasing roller ginning time and costs.

Fibers ginned both ways undergo evaluation

Cotton technologists J. J. Brown, N. A. Howell (now with an industrial firm), and G. F. Ruppenicker, Jr., recently completed the fiber evaluations at New Orleans. They confirmed the effects of roller and saw ginning on fiber, yarn, and fabric properties, and processing performance of Pima S–1. The scientists evaluated combed and carded yarns from roller and saw-ginned cotton, and sewing thread and fabric from combed lots of each. Fabrics were compared before and after finishing (singeing, mercerizing, scouring, bleaching, dyeing, and Sanforizing). Here's what the researchers found:

The roller-ginned cotton was better in grade and preparation (what the gin does to the lint), and had longer and more uniform fibers than saw-ginned cotton.

Ginning method didn't affect strength, uniformity, or elongation at break (extent of stretching before breaking) of the combed yarns. Carded yarns from roller-ginned cotton were much stronger—and combed yarns better looking—than those from saw-ginned stock.

There were no differences in physical properties of sewing threads from combed cotton ginned both ways.

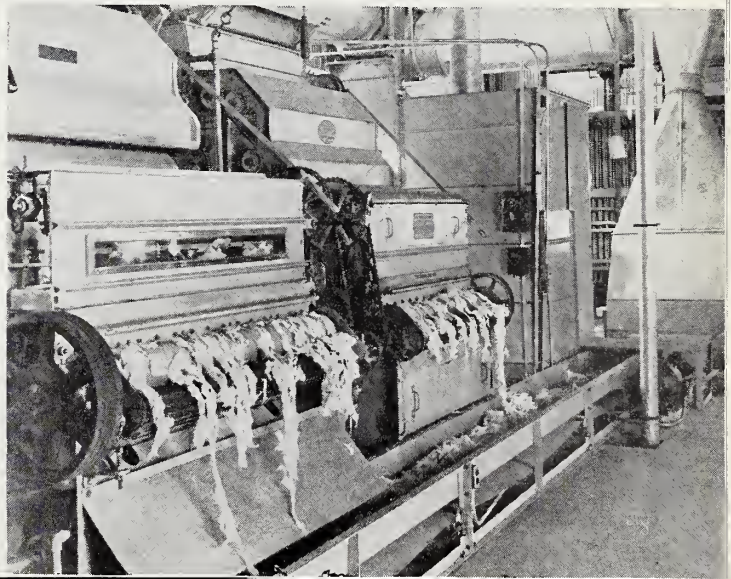
Roller product superior in major respects

Fabrics made of combed cotton ginned by both methods were about equal in tear strength and had the same texture and weight. But saw-ginned cotton produced fabrics that sometimes had lower stretching and breaking strength. There weren't any differences in abrasion resistance between fabrics either before or after finishing.

Fabric woven from the combed saw-ginned stock had many more neps (small tangled balls of cotton fuzz) than the fabric that was woven from roller-ginned cotton.

Saw-ginned cotton showed much greater waste during processing and gave much poorer spinning performance. Researchers concluded that processing costs would be higher and possibly offset any saving in ginning costs. ☆

ROLLER GIN such as this one may be older, slower, more expensive. But it's still best for extra-long-staple cotton.



ORIENTATION PLANTING means more MOISTURE

Seed can be placed so corn plants grow uniformly crosswise of row and shade the ground

■ PLANTING CORN KERNELS by a method called orientation planting looks good as a means of decreasing soil moisture loss from evaporation.

Here's how orientation planting works: Kernels are placed with points down and flat sides running with row. Corn's natural growth pattern brings leaves out almost at right angles to the flat sides of the kernel, and subsequent pairs of leaves emerge slightly counter-clockwise to the previous pair. Thus, leaves of plants from oriented seed grow into the space between rows in such a way that up to 90 percent less sunlight strikes the ground. This reduces evaporation. And since each plant produces leaves at about the same angle, there's less chance of a plant shading leaves of its neighbors. Maximum sunlight falls on leaf surfaces.

Random-planted kernels, on the other hand, produce leaves at many different angles to the row. Plants overlap, and they give the ground less moisture-conserving shade.

ARS soil scientist D. B. Peters and plant physiologist J. T. Woolley, in cooperation with the Illinois Agricultural Experiment Station, report that this system of planting results in additional water for plant use, especially during the critical ear-setting period. Experimental plots on which kernels were oriented out-yielded plots with unoriented controls by 3 to 23 bushels per acre.

Oriented corn yields more

In limited tests during the 1958 season, unoriented seed check-planted in hills 40 inches apart yielded 98 bushels per acre. Corn planted in staggered hills 40 inches apart produced 104 bushels per acre.

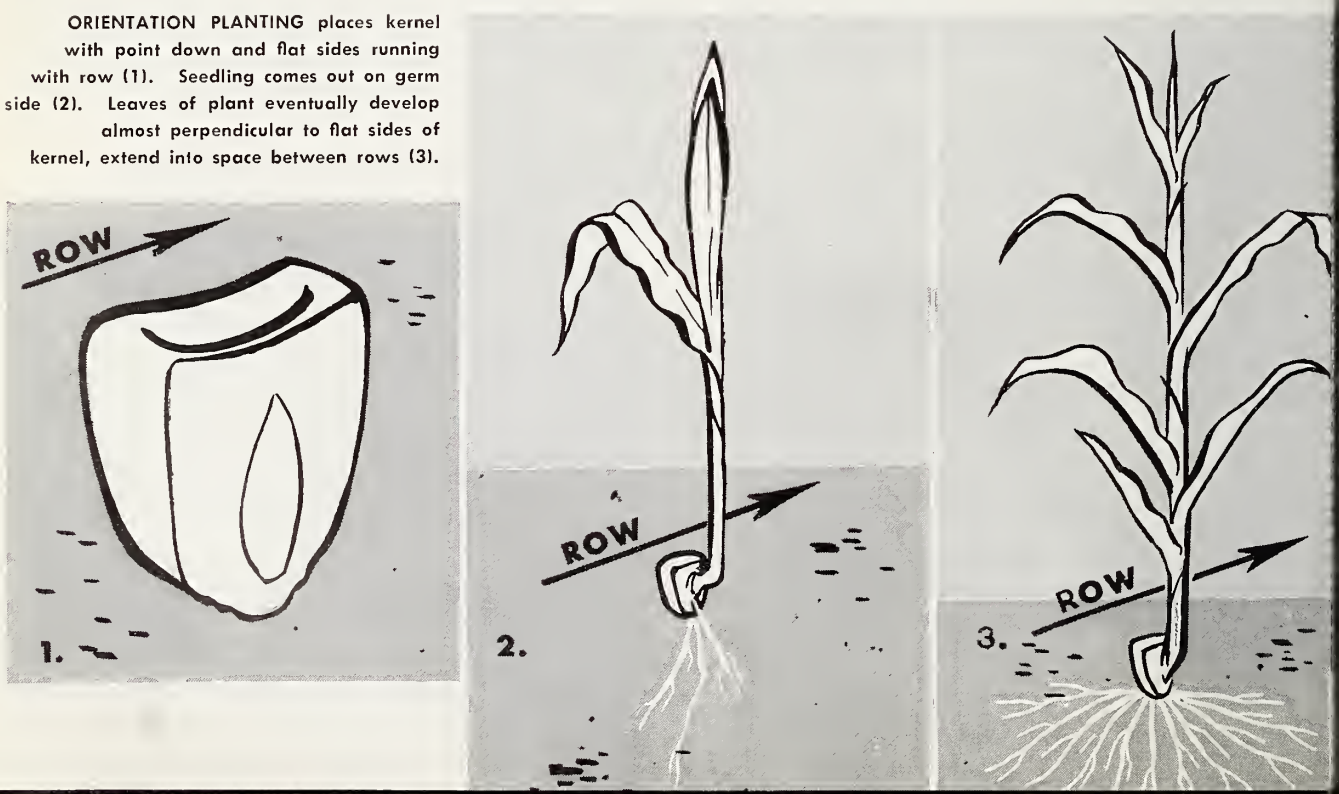
Oriented kernels spaced 10 inches apart in rows 40 inches apart produced 107 bushels per acre. Cutting the distance between rows of oriented seed to 30 inches boosted yield to 121 bushels. Earlier research has shown that checked corn generally yields more than drilled corn.

Shade helps control weeds

Slightly better weed control was observed in plots grown with oriented seed because less sunlight penetrated the corn leaf cover.

Plots used in the experiment were small—26.5 feet by 26.5 feet. A heavy application of commercial fertilizer was made in 1956, and 6 tons of barnyard manure per acre were applied in the fall of 1957. Seed of the

ORIENTATION PLANTING places kernel with point down and flat sides running with row (1). Seedling comes out on germ side (2). Leaves of plant eventually develop almost perpendicular to flat sides of kernel, extend into space between rows (3).



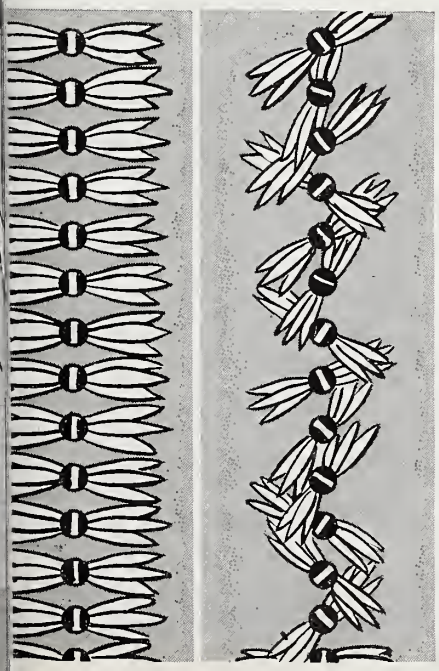
ybrid U.S. 13 was planted by hand n Sidell silt loam soil.

Scientists believe that the difficulies in mechanical planting of oriented eed corn can be overcome by fastening the kernels to a continuous tape nd planting the tape, or through the daptation of existing commercial lanters so they will position the kerels properly in the row.

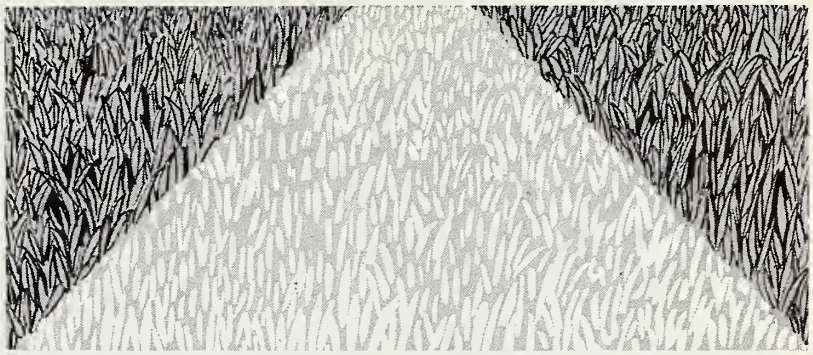
urther tests are planned

Results of 1958 tests are encouraging but not conclusive, the scientists oint out. Plans for 1959 include reeating 1958 tests on larger areas, lus the addition of unoriented drilled orn as another check. Other work lanned includes planting corn in ows parallel to and at right angles to revailing winds in order to check the ffects on yield.☆

PLANTS SHADE GROUND rather than leaves of neighboring plants in orientation-planted corn. This means more sunlight hits leaf surfaces and much less hits soil. Evaporation is reduced, resulting in more water for plants, especially when ears are setting. Extra shade also seems to aid somewhat in controlling weeds.



HOW DALAPON KILLS GRASS



CHARACTERISTIC bleaching follows as plant loses ability to build own vitamin.

■ Discovery that the grass killer dalapon and related chemicals kill plants through vitamin starvation, and finding out just how this is done, may lead to development of more specific and better weed killers.

Dalapon interferes with a plant's formation of pantothenic acid, B vitamin essential to growth and development of all organisms.

The mechanism of dalapon's lethal action was discovered by USDA plant physiologists J. L. Hilton, W. A. Gentner, and L. L. Jansen at the ARS Agricultural Research Center, Beltsville, Md., and biochemist J. S. Ard at the Eastern utilization division, Philadelphia.

Experiments were first run on ordinary yeast in test tubes, then on barley, oats, and ryegrass. The finding that dalapon caused pantothenic-acid deficiency was confirmed when pantothenic acid was applied to the dalapon-treated plants and they resumed growth.

Normally, pantothenic acid is synthesized within a plant by enzymatic action on two known chemicals, pantoate and beta alanine. The plant enzyme has separate sites within its molecule for attaching onto each of these chemicals. The enzyme acts to bind the other two chemicals to itself, temporarily forming a single large compound. Then, the enzyme withdraws from the compound, leaving the pantoate and beta alanine in chemical combination as the new vitamin.

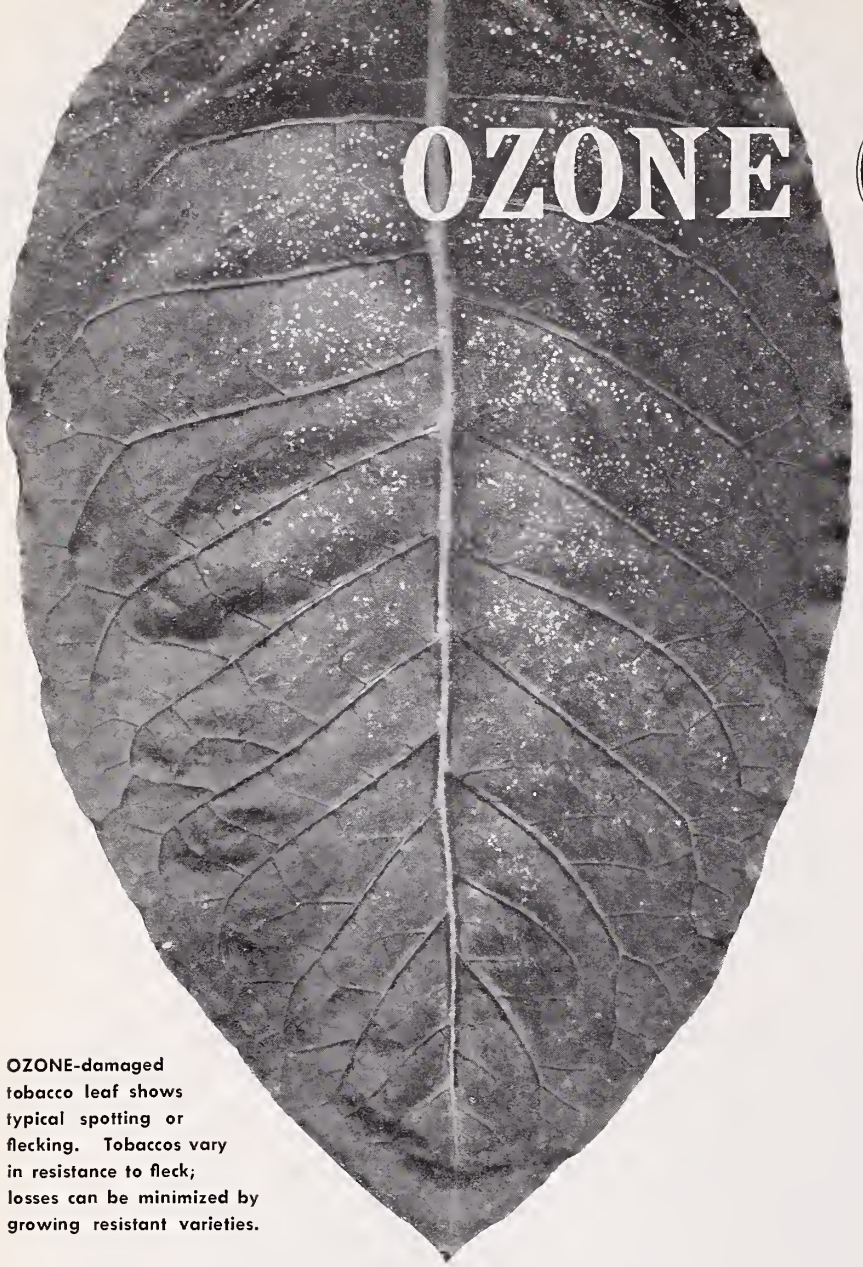
Dalapon and its related compounds also readily attach to the enzyme site for pantoate attachment. When this happens, the enzyme cannot combine pantoate and beta alanine, and the vitamin is not synthesized.

To conduct these experiments, it was necessary to isolate the enzyme. The enzyme is so small it cannot be seen even with the aid of an electronic microscope. But its presence in the test tubes was assured by the reaction shown when dalapon was used to inhibit its action or when pantoate was applied to overcome the action of the herbicide.

One of the new chemicals that has been developed and is being laboratory-tested is a compound comprising part of the chemical structure of pantoate plus the addition of a chlorine atom. The chlorine replaces the hydroxyl groups that pantoate normally contains.

The scientists found that the new compound retained the ability to attach itself to the enzyme, but, because of the chlorine, was unable to combine with the beta alanine. Thus the changed pantoate compound produced the same lethal effect as dalapon and its derivatives. ☆

OZONE CAUSES T



OZONE-damaged tobacco leaf shows typical spotting or flecking. Tobaccos vary in resistance to fleck; losses can be minimized by growing resistant varieties.

Damage to leaf cells is traced to atmospheric gas produced by air pollution with fumes such as those from cars and industry

LARGE AMOUNTS of atmospheric ozone—formed by sunlight's action on mixtures of air with gases such as those from car exhaust and industry—probably cause the serious and costly fleck disease of tobacco leaves.

Recent USDA-State research pinpointed ozone as the most likely cause of the disease. Naturally occurring fleck was studied by ARS agronomist H. E. Heggestad at the Agricultural Research Center, Beltsville, Md., and artificially induced fleck, by plant pathologist J. T. Middleton, of the University of California, at Riverside. Fleck is particularly serious on cigar-wrapper type tobacco.

Gas irritates plant tissues

Harmless amounts of ozone—1 to 3 parts per hundred million—occur naturally in the atmosphere. But large amounts are harmful because ozone's oxidizing action irritates living tissue. Research elsewhere has already shown that high concentrations—from 20 to 30 p.p.h.m.—can injure grapes, beans, and citrus fruit. Large amounts of atmospheric ozone and its reaction products with hydrocarbons are known to be primarily responsible for the destructive smogs that occur in the Los Angeles area.

Fleck disease of tobacco has recently been plaguing growers in Connecticut. The disease is known to occur also in North Carolina, Maryland, and in other places. Losses in the Connecticut Valley alone amounted to over $1 million in 1955.

Since 1954, fleck has developed every year in tobacco breeding plots at Beltsville. To determine possible relationship of ozone to fleck, researchers measured ozone two ways and related the concentration to appearance and severity of the disease.

Heggestad measured ozone with a commercial instrument provided by the U.S. Public Health Service, and with short, folded strips of rubber under tension. The time it takes for cracks to appear in the rubber and the number and depth of cracks are related to ozone concentration.

TOBACCO FLECK

Fleck outbreaks *always* occurred at Beltsville a day after highest ozone concentrations were measured. Heggestad suggests that certain exposures to ozone—about 20 p.p.h.m. for at least 3 hours—may be necessary for fleck to develop. Highest ozone values were found in the middle of warm, *sunny* days with light winds; very little or none at all occurred during night or early morning hours.

Middleton exposed fleck-susceptible and fleck-resistant tobacco varieties to *controlled* amounts of ozone. The artificially induced flecks were similar to those occurring naturally. Exposing susceptible tobacco to ozone concentrations of 25 p.p.h.m. for 6 hours on 3 consecutive days injured 72 percent of the leaves.

A resistant variety exposed under the same conditions showed injury on only 17 percent of the leaves. These varieties showed similar differences in injury after exposure to naturally polluted air in greenhouses at Riverside. No injury developed when plants were grown in greenhouses with the air filtered through carbon to remove ozone and other oxidants.

Folded leaves resist injury

Folded tobacco leaves in the Beltsville tests showed much less or no fleck injury beneath folds, if the leaves remained folded for several days. Tests showed that the stomata (small breathing pores) in the shaded fold stayed closed during bright days. Thus, the ozone-polluted air couldn't get into the leaf to injure the palisade cells just under the epidermis. For some unknown reason, injury occurs first in the secondary layer of cells, then in the epidermal cells.

Similarly, fleck didn't develop after shading with strips of black paper on the leaf. Nor did fleck develop when lanolin was applied to the lower leaf surface (where stomata are most numerous and active) or when the leaf was enclosed in a polyethylene bag to keep out polluted air.

Shaded tobacco is hard hit

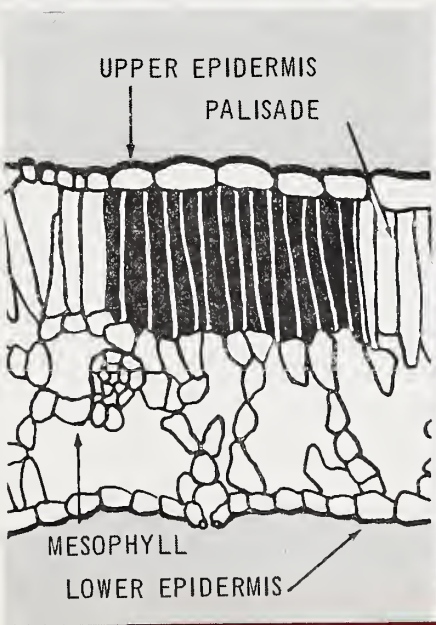
Surprisingly, fleck showed up first and most severely on plants growing under a thin, white cloth shade (as Connecticut cigar-wrapper tobacco is grown). This is probably due to an indirect effect of the partial shade. Under such conditions, plants have thinner and apparently more sensitive leaves. Moisture conditions under a cloth shade are more favorable for uninterrupted plant growth.

Broader studies considered

More and wider research on the relationship of ozone and tobacco injury is expected next summer. Meteorologists and public health officials may cooperate because of their own interests in air pollution.

What we have already learned about ozone's effects emphasizes the seriousness of a problem already of concern in human and animal health. The tobacco studies are only a part of widespread research on this and other forms of air pollution. ☆

FLECK damage shows up first in oblong palisade cells (shaded area) just below the epidermis—scientists aren't yet sure why—later in epidermis. In severe cases, injury may even extend to lower surface of the leaf, where smog damage nearly always occurs first.



FOLDED tobacco leaves showed little or no injury beneath folds, if leaves were folded for few days. Responsible are stomata (breathing pores) which are closed in shaded area on bright days and prevent entry of ozone. Part not shaded by fold clearly shows fleck injury.

2 STEPS TOWARD BETTER TOBACCO

Alkaloid character is heritable, scientists find, and they have devised a way to determine it in young plants

■ GENETIC AND BIOCHEMICAL DISCOVERIES about tobacco, made recently at USDA's Agricultural Research Center, Beltsville, Md., should greatly expedite plant breeding and help build high quality into new tobaccos.

We've found that a plant's alkaloid character is transmitted to the offspring. Also, we've found a simple, reliable way to determine this character in the leaves that yellow before flowering—soon enough to select and breed in the current generation. Heretofore, plants have been crossed in the summer but not tested until fall or winter. This meant discarding many crosses later.

One form of alkaloid converts to another

Alkaloid character depends on whether alkaloid in the mature leaf is mostly nicotine—or includes much of the undesirable nornicotine, which breeders avoid if possible. ARS plant geneticist L. G. Burk and plant physiologist R. N. Jeffrey developed the two new guides—heritability of alkaloid character and early determination of it—in a study of four varieties of tobacco.

The alkaloid of some plants is not stable, converting from nicotine to nornicotine as the plants mature. Burk crossed Robinson Medium Broadleaf variety, a known converter, with three varieties that don't convert. F_1 hybrids inherited the alkaloid class of Robinson, the converter. And converter plants appeared in a ratio of 3 to 1 in each segregating generation—that is, whenever the parent had a gene for conversion paired with a gene for nonconversion. This ratio conforms to an inheritance pattern of a single dominant gene. It means that any experimental seedling with a gene for alkaloid conversion will transmit that character to at least 50 percent of its offspring and thus is less desirable for breeding.

Jeffrey and Burk set out to learn when nicotine conversion to nornicotine occurs in tobacco. They found that when conversion takes place, it does so as the leaf yellows. Researchers have been delaying alkaloid tests until the plant matures—that is, long after seed set. But the experiments at Beltsville showed that the bottom leaves that yellow while a seedling is small and still in the greenhouse pot will give a true test.

Method greatly speeds screening of plants

By using the simple, quick paper-chromatography method of separating the leaf's alkaloid components, a technician can screen about 200 plants daily, compared with only 12 by older methods. So a large population can be grown and tested early and the next cross made within a single generation, rather than in the next generation or with plants of indeterminate alkaloid character.

There is much to be learned about the alkaloid chemistry of a tobacco plant. For instance, the researchers are studying the conversion behavior of other commercial varieties, of *Nicotiana* species, and crosses between them. There's also the question why conversion occurs in occasional plants of varieties that are not usually converters. And we want to know why crosses do not behave quite in accordance with the dominant-gene pattern. ☆

COOL the MILK and USE the HEAT

Experimental heat-pump unit puts bulk tank's waste energy to work warming water, room

Modern dairy farms equipped th bulk milk coolers are wasting at energy that can be put to good e.

The heat drawn from warm milk the cooling tank has been used to at water for washing milking equipent or to help heat the milk house. his was done with an experimental it cooperatively designed by USDA d State agricultural engineers. The me basic equipment did both jobs taking advantage of the heat-pump inciple of this type refrigeration. The large-capacity refrigeration its that are used in bulk cooling reice milk temperature by transferring at into water or air. After being armed, the water or air is generally disposed of. This wasted heat may seem insignificant, but in time it adds up to quite a bit because of the large cooling capacity of today's bulk milk tanks. In a typical bulk milk handling operation, a tank cooling 200 gallons of milk a day will pump out heat energy equivalent to more than 9,000 kilowatt-hours of electric energy during a year.

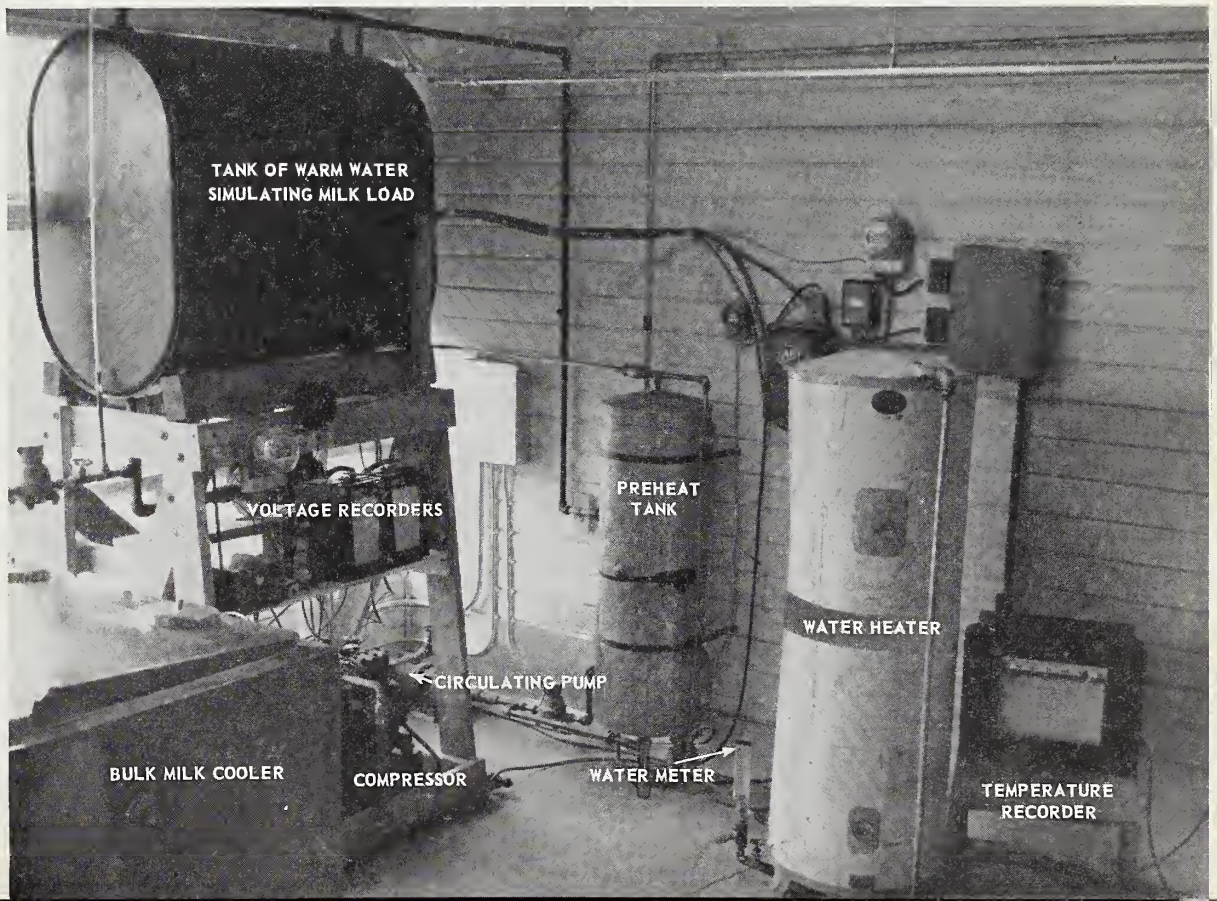
Why not conserve some of this heat and put it to work in the milk house?

That's just what ARS agricultural engineer M. C. Ahrens and engineers of the Washington Agricultural Experiment Station have done. They have adapted a cooling unit so that it also heats supply water used in cleaning the bulk tank and milking utensils. This unit uses a 400-gallon bulk milk tank with a 2-horsepower refrigeration unit. Directly connected is a circulating pump that carries the heat energy through a water-cooled condenser. Then, warm water from the condenser is run into the top of a 42-gallon preheat water tank. Supply water from the tank is drawn at a temperature of 120° F. into a conventional electric water heater for storage. In this manner, it is possible to recover and put to good use the heat energy equivalent to about 4,000 kilowatt-hours.

Wash water is preheated

The advantage gained from saved energy was greatest when the preheat

TURN PAGE



HEAT-PUMP inciple was applied in this laboratory milk room at Washington Agricultural Experiment Station, Pullman. Scientists used the cooling and heating system to measure power for cooling different milk loads, while varying temperatures and amounts of wash water heated.

COOL the MILK and USE the HEAT
(Continued)

tank's capacity was approximately 50 gallons, or about equal to the amount of wash water used after each milking. Preheating more water than that or increasing the preheat temperature would recover more heat. But tests showed that the increased electric energy required to run the compressor and pump would offset any savings.

Combining the two jobs of heating and cooling is quite simple and relatively economical. Cost of the extra equipment is listed at about $175. This includes circulating pump, galvanized vertical tank, water solenoid valve, thermostat for the preheat tank, pipe, insulation, check valve, and miscellaneous fittings.

Room-heating unit tried

Heating the milk parlor in winter is an alternate way to save approximately 4,000 kilowatt-hours of electric energy. For room heating, an air-cooled condenser may be connected parallel with a water-cooled condenser system, and controlled by solenoid valves. The valves, regulated by a thermostat in the milk house, switch on the system when room temperature is below the ther mostat setting.

This installation is more compl cated and would take $150 to $20 more in equipment, including 2 re frigerant solenoid valves, a 2-horse power air-cooled condenser, 2 refri erant check valves, and an air thermo stat. The extra expense woul probably pay off only in severe cl mates.

So far, only laboratory results ar available to compare the two system for workability and possible saving Dairymen would have to work ou their own installations, as packa units are not now available. ☆

TIME TO ADJUST FARM RENT PATTERNS?

■ Some of our traditional leasing or renting arrangements may need to be revised a bit if they are to retain their status as a step to farm ownership. At the same time, attracting tenants with a better deal may mean a better deal for landlords as well.

Under the conventional 50–50 livestock share lease on eastern-Wisconsin dairy farms, for example, a tenant's costs for contributions he has traditionally made—labor, machinery, and half the livestock—have increased more since 1940 than have a landlord's costs. A tenant may now furnish up to 60 percent of the total, though his income share remains half. USDA and State farm economists, studying this predicament of some tenants in the area, find that modification of 50–50 leasing to expand the tenant's income base may be the answer.

When first established, 50–50 sharing was probably a fair arrangement in dividing incomes for landlords and tenants. Moreover, a tenant's prospects for buying his own farm were probably better, because capital requirements for an economical-sized farm were much less than today. The Federal-State study shows the increased capital needed today may have restricted opportunities for young tenants dependent on farm income and without other assistance. On farms that gross more than $5,000 a year from farm sales, tenant income from 50–50 sharing is probably adequate to allow him to build up his capital. These tenants are exceptional, however, for most Wisconsin dairy farms gross less than $5,000.

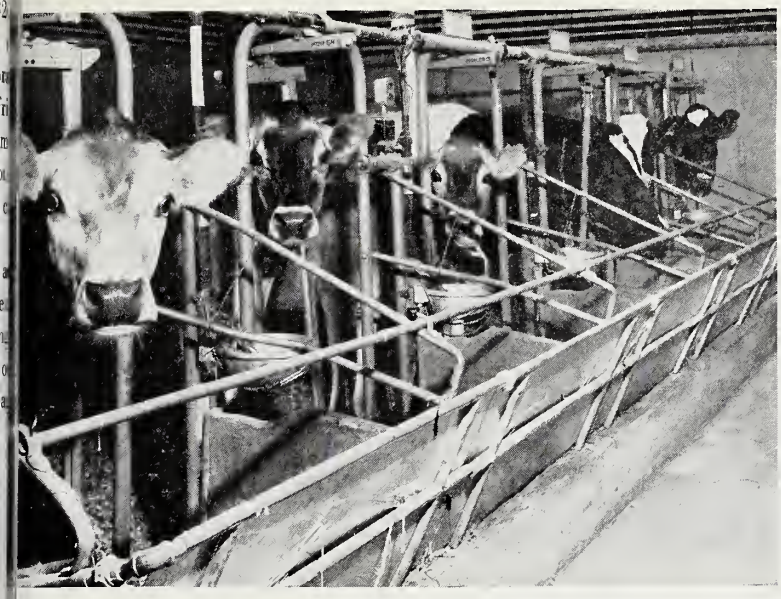
The larger tenant capital required for leasing an economical farm on a 50–50 basis handicaps beginning farmers. In the Wisconsin study, farm economists H. I Hill, of ARS, and S. D. Staniforth, of the Wisconsi Agricultural Experiment Station, found that a tenant ha to supply livestock and machinery worth $4,000 to $6,00 or more to lease a farm of adequate size. Leasing smaller unit didn't return enough to build up investmer capital without cutting into income or family livin Furthermore, young tenants often cannot qualify fc credit to expand operations.

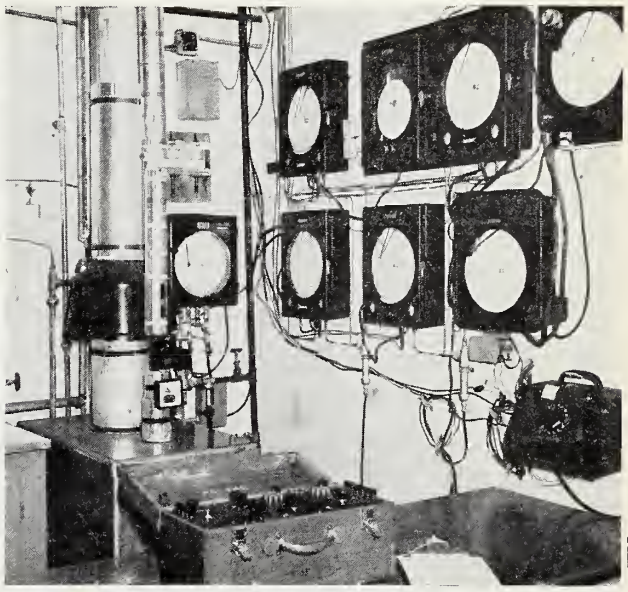
Smaller tenant investment and return may pay

The researchers say it may be desirable to modif leasing arrangements for tenants with limited capita Landlords with large units might also profit if they coul attract better tenants through lower lease requirement This could be done by allowing tenants to supply a smalle share of resources on a large economical unit. Thoug he would also get a smaller share of the farm's incom under this arrangement, a tenant could realize higher tot income. Hill and Staniforth, in analyzing various-size farms and their income possibilities, found that the te ant's labor and $1,400 invested in a small farm under 50–50 livestock lease returned him $1,100. With t same investment and labor on a large farm, a 35-perce tenant share returned him $3,300.

Starting young beginner tenants on such modifie arrangements would make the traditional livestock sha lease more workable for both parties. In the long ru it would also give tenants a chance for larger responsibil ties and perhaps future ownership. ☆

COWS LIKE COMFORT





MILK COWS in temperature-controlled experimental stalls (left) at Columbia, Mo., were tested in temperatures from 5° to 105° F. Greatest losses in milk production occurred at highest temperatures. Artificial weather conditions—temperature, wind, humidity, radiation—were maintained by controls (right) in adjoining room. Tests on effects of environment on animal production have been conducted here since 1948.

asic research is revealing ow weather affects cows and ow they can be protected

Cows, LIKE HUMANS, like to be omfortable, and they react to dis-omfort by giving less milk. This ay be Bossy's way of saying she'd ke well-ventilated quarters or even n air-conditioned apartment.

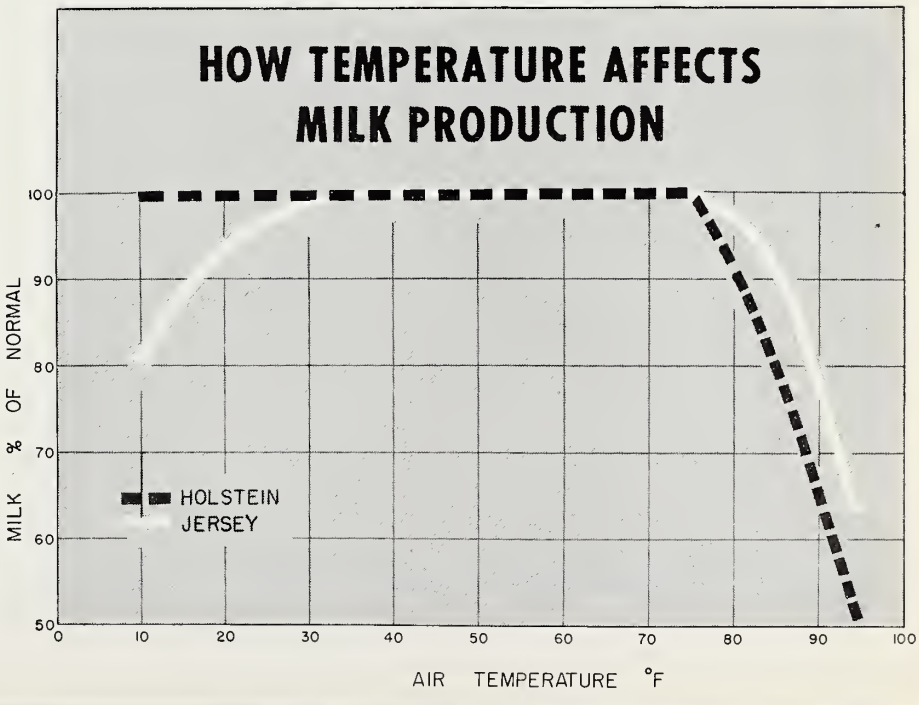
To try to translate her message nto understandable terms, USDA and tate researchers have been studying ilk cows in experimentally condi-oned and controlled quarters.

Long-range basic studies by USDA nd Missouri Agricultural Experiment tation, Columbia, are showing us hat combinations of temperature, umidity, wind, and solar radiation nake a cow uncomfortable enough to ower her milk production. These tudies are also showing how we can helter Bossy against such weather xtremes. Information of this kind, f course, will help us work out prac-ical ways of meeting cows' needs.

In general, tests by ARS agricul-ural engineer R. G. Yeck in the cli-

TURN PAGE

JERSEYS AND HOLSTEINS kept up milk flow between 40° and 75° F. (with relative humidity between 55 and 70 percent) but fell off sharply above 75° F. Holsteins produced normally even at 10° F., but Jersey production began decline at 30° F., fell 20 percent at 10° F.



COWS LIKE COMFORT

(Continued)

matic laboratory at Columbia have shown that milk production dropped sharply as temperatures rose above 75° F., with relative humidity at 65 percent. Production by Holsteins fell 10 percent at 80° F., and 35 percent at 90° F. Jerseys and Brown Swiss didn't drop as sharply.

Heat, humidity cause drop

Relative humidity had no appreciable effect on milk production or feed consumption at temperatures between 17° and 75° F. Above 75° F., however, high humidity accentuated the effects of high temperature on both. At 85° F., for instance, a relative humidity of 44 percent caused only a slight decline in milk production by Holsteins. But a relative humidity of 90 percent at that temperature caused a sharp drop, and affected animals took about a week to recover from the decline.

Production by Jerseys also declined—but somewhat less—at the higher humidity. Brown Swiss losses were the least. Cows within a breed, however, varied enormously in response to extremes of weather.

Wind from propeller-type fans blowing on the backs of cows was found to be beneficial to milk production in hot weather. Winds of 5 and 10 miles per hour at a temperature of 80° F. brought milk production back to nearly normal. Nine mile-per-hour winds at a temperature of 95° F. restored from 41 to 77 per cent of the losses in production.

Fat goes up as milk falls

As milk decreased with extremely high or low air temperatures, butter fat increased just as it does under normal lactation decline.

Two 7½-horsepower motors provided enough power in these tests to hold the temperature as low as 60° F. in the experimental 6-cow stable. In a well-insulated structure, 1 ton of refrigeration would be enough for 3 high-producing Jersey cows (assuming three-quarters of the heat load comes from the animals). ☆

FOOD & HOME · FOOD & HOME

PREVENTING FLOC IN ACID SIRUPS

■ Refined granulated cane sugar sometimes lumps or "flocs" in acid sirups like soft drinks, bottlers' concentrates, and pharmaceutical sirups. Actually, the floc consists only of harmless substances normally found in trace amounts in refined cane sugar and gradually precipitated out by the acid in the sirup. But consumers think the floc is foreign matter and object to it.

USDA scientists, in cooperation with the bottling and refining industries, are finding out why this happens and how it can be prevented. Research has developed improved tests to check refined sugars for their flocculating tendencies, and ways to determine the various floc components. Such basic information should help in producing cane sugars of lower floc content, and help the beverage industry to overcome an annoying situation.

Chemists M. F. Stansbury and C. L. Hoffpauir, ARS Southern utilization division, New Orleans, found floc consisted mostly of three types of substances: free carbon; organic compounds such as starch, some protein, and lipids in the form of wax; and inorganic compounds in the form of silica and other ash constituents.

Much of the carbon was in the form of decolorizing carbon, which is routinely used in sugar refining. The lipids apparently come from the wax cuticle normally found in sugarcane and in trace amounts in refined sugars. Some refiners think the lipids cause flocculating and go to much trouble to remove them as completely as possible.

The researchers modified presently used commercial tests to check refined sugars for flocculating tendencies. Changes speeded up the preparation, storage, and observation of test sirups. The basic test consists of placing a treated sugar sirup into a heated water bath and allowing it to stand for a predetermined time. The combination of proper treatment and temperature causes floc to develop. This test will show if the sugar *has* a tendency to floc, and if so, how much.

Scientists also developed tests to determine each of the components of floc to see if any of them was the key to floc formation. Sugars containing the most floc were generally those containing the most decolorizing carbon. These finely divided carbon particles may serve as nuclei for the aggregation of colloidal materials that make up the floc. The low pH of the acid sirup, while necessary for use in bottled drinks, also speeds up the coagulation of floc particles.

Researchers feel that it's possible to minimize flocculating by eliminating most of the carbon and other floc colloids before crystallizing the sugar.

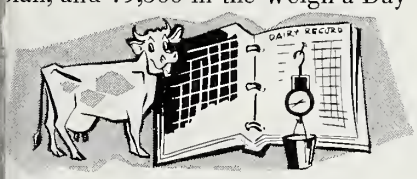
The Western utilization division, Albany, Calif., solved a different flocculating problem in beet sugar about 4 years ago. Scientists found that at least two saponin compounds combined with particles of filter aid, charcoal, or foam breakers to form floc. This was overcome by modifying and improving the method of processing. ☆

DHIA plans pushed

Secretary Ezra Taft Benson recently launched a campaign to get more farmers to keep production records under the National Cooperative Dairy Herd Improvement Program.

County agents, vocational-agriculture teachers, Dairy Herd Improvement Association supervisors, artificial-breeding technicians, bankers, and others in contact with farmers will stress the value of records to dairymen not now keeping them.

This cooperative effort of USDA and the State extension services has helped improve herds over the past 50 years. Over 2 million cows—10.3 percent of the Nation's dairy cattle—are enrolled in the 3 plans. About 1,549,000 cows are in the Standard plan, 490,000 in the Owner-Sampler plan, and 79,500 in the Weigh-a-Day-



a-Month plan. Facts obtained through DHIA help in selecting good herd replacements, spotting unprofitable cows for culling, and feeding the herd economically.

Orchardgrass ready

Certified seed of Potomac orchardgrass is now available from commercial seed houses. It is a dark-green, leafy, rust-resistant, productive variety that maintains high yields for long periods.

This grass was developed at USDA's Agricultural Research Center, Beltsville, Md., in cooperation with several State agricultural experiment stations. The Department, however, has no seed for distribution.

Foundation seed of Potomac is being produced under the auspices of the National Foundation Seed Project, a cooperative Federal-State-industry effort organized in 1949 to maintain foundation seed supplies of superior grass and legume varieties.

The seed was first produced in quantity in 1956. Certified seed has been grown in Illinois, Maryland, Montana, Oregon, and Washington. Information about the performance of Potomac and recommendations for its use in pasture and hay mixtures can be obtained from State experiment stations and extension services.

Sand fly is up again

We thought we had the Florida sand fly licked, but it's up again, biting people with all its old fury.

USDA laboratory tests show the salt-marsh sand fly (*Culicoides furens*) has developed resistance to several insecticides that had given excellent control for several years.

Control efforts started in 1935 with ditching, diking, and pumping of Florida's eastern tidal marshes, where the flies breed. The efforts were effective only in certain areas.

Later, the flies were sprayed in the air and on the ground, but that was effective for just a few days.

Then the tidal marshes were sprayed with dieldrin, heptachlor, and malathion to kill the larvae. This worked well for 3 or 4 years, but by 1957, larvae were again surviving and adult flies were again established as the biting pests that hinder economic development along the coast.

In laboratory tests, larvae collected from marshes that had been sprayed yearly since 1954 showed they had developed 100-fold resistance to dieldrin, heptachlor, chlordane, and lindane, and about 10-fold resistance to endrin. Larvae from untreated marsh were normally susceptible.

Laboratory director named

W. A. Hagan, dean of the New York State Veterinary College at Cornell University, Ithaca, has been named director of USDA's new National Animal Disease Laboratory, under construction at Ames, Iowa.

Hagan, about to retire from his post at Cornell, will take over his new duties on January 1, 1960. The laboratory will be completed and operating about November 1960.

This internationally known scientist has served as consultant on a wide variety of animal-disease and other veterinary-medical problems. He reviewed field activities of USDA's old Bureau of Animal Industry and made recommendations for continuing improvements, served as member of an Advisory Committee on Foot-and-Mouth Disease, contributed to the establishment of the U.S. Animal Disease Laboratory at Plum Island, N.Y., and is chairman of the Study Committee on Brucellosis.

He is a member of numerous professional and honorary societies and has authored more than 100 papers and publications, and a textbook.

Enough trace minerals

Cattle grazing on Louisiana's longleaf pine and bluestem range don't need trace-mineral supplements.

USDA's Forest Service and the Louisiana Agricultural Experiment Station found that the abundant forage plants—pinehill bluestem, slender bluestem, narrowleaf panicum, and swamp sunflower—supplied all cattle needs for cobalt, iron, copper, manganese, zinc, molybdenum, magnesi-

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um, and sulfur, as well as for calcium and potassium. Moreover, the plants contained good supplies of these elements at all stages of growth.

There is need, however, to supplement this forage with additional crude protein and phosphorus.

Two new blueberries

Two new varieties of rabbiteye blueberries have been developed for the coastal plain from the Carolinas to Louisiana. These blueberries resulted from cooperative research by the North Carolina Agricultural Experiment Station and USDA and have been tested since selection in 1944.

Garden Blue variety is a high yielder of medium-sized fruit, averaging 130 to 135 berries per half-pint cup. The berries are round, firm, and blue. They have a small dry scar and good flavor. The plant is vigorous, upright, and spreading. The fruit is

well distributed on long fruiting shoots. That makes picking easy. In eastern North Carolina, the fruit ripens from mid-June to mid-July.

Menditoo, a garden and local-market variety, is notable for high flavor and large berries—95 to 100 per half pint. Berries are round, medium firm, dark blue, free of grit cells, and have small dry scars. The fruit begins to ripen about a week later than Garden Blue and continues for 6 to 8 weeks. The plants have medium vigor, spreading habit, and loose, medium-sized fruit clusters.

Cultivated blueberries are new from the Carolinas to Louisiana. The new ones do well in the short winter. Northern varieties, needing a long rest, don't do well there.

A list of nurseries that have plants for sale can be obtained from F. E. Correll, Department of Horticulture, North Carolina Agricultural Experiment Station, Raleigh. Neither the North Carolina station nor USDA has plants for distribution.

Using water efficiently

Timing irrigation properly and keeping soil fertility high are musts in the semiarid high plains of the Southwest if the limited water supply is to be used efficiently.

Hybrid grain sorghum, a 2-million-acre crop on the Texas high plains, is an example. In USDA studies at Bushland, Tex., efficient water usage required 20 to 22 inches of moisture in the growing season (including plenty at the boot and soft-dough stages), and high fertilization—up to 240 pounds of nitrogen and 20 pounds of phosphorus per acre.

This was pointed up by tests in the dry year of 1956 when rainfall totaled 6¾ inches from June through October. Plots receiving a preplant irrigation of 4 inches and a post-emergence irrigation of 3 inches yielded only 60 pounds of grain sorghum per acre-inch of soil moisture. But when the same irrigations were supplemented with 3 addi-

tional 4-inch applications—at 26-inch height, at flowering, and at soft-dough stage—the plots yielded 238 pounds more grain per acre-inch of water.

Similar test methods increased yield per acre-inch of water an average of 35 pounds in 1958 and 86 pounds in 1957—years of more nearly average rainfall distribution.

The studies also showed the important relationship between maintained soil fertility and efficient water usage. Adding nitrogen to test plots in 1958 increased production an average of 152 pounds of grain per acre-inch of ground water.

Dr. Stiebeling gets award

Hazel K. Stiebeling, Director of USDA's Institute of Home Economics, is one of five persons given the Gold Medal Presidential Award for Distinguished Civilian Service this year.

Her work in USDA for the past 27 years has led to notable improvement in nutrition of the American people. Publications to help homemakers apply results of research done under her direction have been "best sellers" for years. Her work has brought her world-wide recognition.

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